

Dust Generation Modeling - Source Terms and Microscale Transport from Military Installations

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Introduction

Dust is a major particulate emitted from military installations, especially those that perform extensive training with tracked vehicles and high explosive artillery ranges. Concerns are frequently raised when dust exiting a military reservation consistently exceeds particulate sampling standards, when local natural vistas appear to be degraded, and especially when visible dust plumes significantly restrict local visibility for period of time. This poster presents some examples from the U.S. Army Research Laboratory measurement and modeling efforts over the past twenty years to characterize and generalize airborne military dust. This has included measurement and modeling of production source terms and cloud optical properties. Optical mass extinction coefficients tie reduced meteorological visibility to airborne dust mass concentration, composition and particle size distribution by mass. We show examples of dust transport modeling using the High Resolution Wind (HRW) Model that suggest significant reductions in near-surface visibility to less than 1 km are possible at distances of more than 10 km downwind. HRW is particularly applicable to modeling the microscale effects of complex terrain and canopies on boundary layer transport and, combined here with the Risoe RIMPUFF dispersion model, can identify regions of local concentration maxima and visibility minima due to terrain effects. Finally, dust generation from local events can often be compared in context with the historical frequency and duration of natural blowing dust (visibility reduced to less than 1 km) and dust storms (visibility less than 1 km) events. We show examples from the published global boundary layer dust occurrence climatology by B. Hinds and G. Hoidale (Atmospheric Sciences Laboratory, 1975) using observation data spanning 1948 to 1973.